# Fire Program Analysis – Preparedness Module
## FPA Heuristic and GPO

**Issue:** FPA PM uses a heuristic which may not yield a global optima.

FPA PM uses optimization techniques to model the effectiveness of potential fire management organizations. Optimization programs can take several forms.

The most straightforward optimization technique is Global Problem Optimization (GPO). GPO considers every possible combination of fire resources and deployments to identify the most effective organization. GPO guarantees that the result is the best possible for the given model. There may be other equivalent best possible answers, but none better. Because GPO exhaustively explores every possible combination, it requires lots of computation time and memory. The FPA PM model is too complex to be solved via GPO in a reasonable time.

One way to solve problems that are too complex is to use a simplifying heuristic. Heuristics do not examine every possible organization and deployment combination, so may not find the best possible organization. FPA PM pre-analyzes model data, deriving and applying "extra" information to reduce complexity while still finding a good answer. This includes assessing the effectiveness of proposed resources to reduce the combinations considered. The heuristic also considers the current organization's mix of resources. This external information - the judgment that went into creating the current organization – helps avoid pruning resources that might in fact be more effective. This approach guarantees that existing resources will be considered in an answer, regardless of possible imperfections in other parts of the heuristic. The results may show a bias toward the existing organization, since that set of resources is the only one guaranteed to be considered in the solution.